

REMARKS/ARGUMENTS

Claim 7 has been amended by this response. No claims have been canceled or added. Accordingly, claims 1-19 remain pending.

Embodiments in accordance with the present invention relate to methods of polishing a semiconductor substrate, wherein a rising step is interposed between polishing steps utilizing the same, unstable polishing fluid:

a "polishing fluid" is a fluid that can be used in a CMP process to polish a substrate and an "unstable polishing fluid" is a polishing fluid that when used in a CMP step exhibits a polishing removal rate that decreases with time under conditions where other polishing fluids are stable, e.g., due to pad conditioning. (Emphasis added; page 2, lines 15-18)

The rinsing step in accordance with embodiments of the present invention allows polishing with an unstable, cerium-based polishing fluid, to proceed without a diminished rate of polishing:

The method divides the polishing step into at least two separate polishing substeps with a rinse step inserted between the polish substeps. The rinse step rinses used polishing fluid from the polishing pad and allows the subsequent polish substep to continue or complete the polishing process at a faster polishing rate than would be achievable without the rinse step and at improved uniformity and planarity. (Emphasis added; page 4, lines 18-25)

I. Rejection of Claim 7 Under 35 U.S.C. §112

As an initial matter, Applicants appreciate the Examiner's indication of the allowability of claims 7-13, 15, 17, and 19. As discussed in detail below, claim 7 is amended herein to overcome claim rejections based upon indefiniteness. This amendment of claim 7 should not affect the patentability of this claim.

Claim 7 stands rejected under 35 U.S.C. §112, first paragraph, as containing subject matter which was not described in the specification. Claim 7 also stands rejected under 35 U.S.C. 112, second paragraph, as being indefinite. Claim 7 has now been amended to overcome these rejections as follows.

Rejection of claim 7 under 35 U.S.C. §112 is based upon the following former language of claim 7: "wherein the polishing pad is not roughened by a pad conditioner between polishing the first and second portions of the material".

Claim 7 has now been amended to delete this phrase, adding instead the phrase: "conditioning the first polishing pad only during one of removal of the first and second portions, and following removal of the second portion of material". (Emphasis added). Support for this amendment may be found in the application at least as follows:

[p]olishing step 130 completes the polishing of wafer W by removing a second portion of material from the wafer. Conditioning of pad 17 is done sometime after step 130 when wafer W has been completely polished. Typically, conditioning of pad 17 will be done by applying a conditioning fluid to the pad from fluid supply 27 while wafer W is being transferred to or from platen 15. Alternatively, conditioning can be done in situ (while the wafer is being polished) as is known in the art. (Emphasis added; page 6, lines 14-20)

As amended, claim 7 of the subject application now complies with all requirements of 35 U.S.C. Accordingly, Applicant requests examination and allowance this claim as well as claims 8-13, 15, 17, and 19 depending therefrom.

II. Rejection of Claims Under 35 U.S.C. §103

Claims 1-6, 14, 16, and 18 stand rejected under 35 U.S.C. 103(a) as being unpatentable over published Japanese patent application no. 11-138418 to Yoshida et al., ("the Yoshida application"). Because the Examiner has asserted that U.S. patent no. 6,191,038 is an English language equivalent of the Yoshida application, references herein to specific portions of the Yoshida application are to U.S. patent 6,191,038.

The Yoshida application relates to chemical mechanical polishing methods wherein the changes in roughness of a polishing pad are detected, and the polishing pad is then conditioned (dressed), in order to ensure uniform planarization. Nowhere, however, does the Yoshida application teach, or even suggest, application of such chemical mechanical polishing utilizing a cerium-based slurry, as is recited in pending independent claim 1. Acknowledging this absence of such a teaching by the Yoshida application, the Examiner has combined this reference with prior art purportedly admitted by Applicants.

As a threshold matter, the Examiner is reminded that in order to combine reference teachings as a basis for rejection of claims as obvious,

there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. (Emphasis added; MPEP 2143)

Moreover, such teaching or suggestion to make the claimed combination must be found in the prior art, not based upon applicant's disclosure. See In re Vaeck, 947 F.2d 488 (Fed. Cir. 1991).

Here, the Yoshida application contains no suggestion or motivation for its combination with the known cerium-based slurries described by Applicant. Specifically, the Yoshida application focuses upon CMP processes wherein the polishing pad is dressed between steps. The Yoshida application describes this intervening pad dressing step as necessary owing to the tendency of chemical mechanical polishing pads to become clogged with materials polished from the substrate:

dresser 107 comes into contact with the polishing surface of the polishing pad 103, thereby roughening the polishing surface of the polishing pad 103 that has got clogged because of the attachment of polishing debris and/or abrasive particles contained in the abrasive. In this manner, the polishing surface of the polishing pad 103 regains its capacity to hold the abrasive. (Emphasis added; col. 7, lines 42-50).

As described at length above, however, the use of unstable cerium-based slurries in accordance with the present invention does not offer the problem of accumulation of material on the polishing pad that is addressed by the Yoshida application. Specifically, the instant application explicitly teaches that the cerium-based slurry:

exhibits an oxide removal rate that decreases significantly during the polishing period (e.g., during one minute of polishing) where the decrease is not due to improper pad conditioning. The polishing properties of the Hitachi Chemical slurry can be contrasted with most slurries commonly used in CMP processes where removal rate of the polished material is substantially constant with time when the polishing pad is properly conditioned. (Emphasis added; page 4, lines 12-17)

As indicated by the above passage, chemical mechanical polishing with an unstable cerium-based slurry would result in diminished polishing over time. Hence, use of such an unstable polishing fluid would cause a corresponding decline in the rate of accumulation of material on the polishing pad.

Based upon the known polishing characteristics of unstable cerium-based slurries, one of skill in the art would not have been motivated to apply the teaching of the Yoshida application in the context of such slurries. Specifically, the diminished polishing rate over time exhibited by unstable cerium-based slurries, would not result in excess accumulation of polished

material on the pad, removal of which is the motivation for the rinsing step of the Yoshida application.

Based upon the arguments presented herein and evidence submitted in the accompanying declaration, it is respectfully asserted that there is no motivation to utilize the Yoshida application in conjunction with a cerium-based slurry. The Examiner's obviousness rejection of claims 1-6, 14, 16, and 18 is improper and should accordingly be withdrawn.

In view of the foregoing amendments and remarks, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested. If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,



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